

Montana Bureau of Mines and Geology NGWMN Final Technical Report

Award Number: G16AC00080

Agency Name: Montana Bureau of Mines and Geology

Title: Montana Bureau of Mines and Geology State-Wide Groundwater Level and Groundwater Quality Monitoring Network, Current Data Provider Maintenance Funding

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Term Covered: July 21, 2016 to July 20, 2019

Date of Final Report: December 13, 2019

Background

The Montana Bureau of Mines and Geology (MBMG) maintains a statewide groundwater monitoring network to collect water-level and water-quality data from about 850 wells. Many of these wells are completed in Principal Aquifers that include the heavily developed intermontane basin aquifers in the west (S100NRMTIB), and the less intensively developed but widely used alluvial (N100ALLUVL), Lower Tertiary (N300LTRTRY), Upper Cretaceous (N300UPCTCS), Lower Cretaceous (N300LCRTCS), and Paleozoic aquifers (N500PLOZOC) in the east. MBMG became a NGWMN data provider in 2015 and at the start of this project provided water-level data for 227 sites, and water-quality data for 58 sites.

- **Description of work done to support the NGWMN as a data provider**

The work performed for award G16AC00080 was under Objective 2: to maintain persistent data services between MBMG and the NGWMN portal. Specific tasks included: updating the registry with new or dropped sites, maintaining MBMG database tables for all wells that are in the NGWMN, reviewing and revising MBMG database structures to accommodate any NGWMN enhancements, and maintaining software and providing updates as necessary.

The MBMG Data Center databases are housed in Microsoft SQL Server, either 2012 Standard or 2016 Enterprise Edition. The databases store the data elements served to the NGWMN portal including well construction details, lithologic descriptions, water levels, and inorganic water quality data.

During the performance period, seven wells were dropped from the NGWMN either because of difficult access, well damage, or the landowner no longer granted access. The sites are still included in the registry but the display function has been deactivated. The NGWMN Site ID's are listed below:

<u>NGWMN Site ID</u>	<u>National Aquifer</u>	<u>Local Aquifer</u>	<u>Aquifer Type</u>	<u>Well Depth (ft)</u>	<u>WL Network?</u>	<u>QW Network?</u>
MBMG:25200	Lower Cretaceous aquifers	217KOTN, KOOTENAI FORMATION	CONFINED	400	Yes	No
MBMG:23991	Upper Cretaceous aquifers	211EGLE EAGLE SANDSTONE	CONFINED	680	Yes	No
MBMG:22380	Upper Cretaceous aquifers	211JDRV JUDITH RIVER FORMATION	CONFINED	965	Yes	Yes
MBMG:15907	Upper Cretaceous aquifers	211EGLE EAGLE SANDSTONE	UNCONFINED	97.6	Yes	No
MBMG:1330	Upper Cretaceous aquifers	211LNCE LANCE FORMATION	CONFINED	445	Yes	Yes
MBMG:95030	Upper Cretaceous aquifers	211FHHC FOX HILLS-HELL CREEK AQUIFER	CONFINED	360	Yes	No
MBMG:74121	N. Rocky Mountains Intermontane Basins	400BELT BELT SUPERGROUP	CONFINED	369	Yes	No

Also during the performance period, MBMG monitored overall NGWMN service usage and availability, when necessary responding to questions from NGWMN portal staff.

- **Description of any updates made to web services during period of award**

MBMG Data Center upgraded Geoserver and transferred service delivery from the old webserver to new web servers during MBMG equipment upgrades in May 2018.

Additionally, MBMG modified services and added fields to maintain currency with NGWMN standards. The following fields were modified to meet the Minimum Data Element Requirements:

- Accuracy of water-level measurement (water levels)
 - Analytical Method Name (water quality)
 - Depth of Casing interval unit of measure (casing)
 - Depth of Screen interval unit of measure (completion)
 - Lithology ID (lithology)
 - Observation Method (lithology)
- **Description of any problems encountered in serving data to the NGWMN data portal**

An internal MBMG quality assurance review discovered an issue with casing and screen data being duplicated in the portal “Well Log” tab. An example from MBMG-133392 is presented below:

MBMG - GWIC:

Add record										Casing table records			View Audit History	
Opt	From	To	Dia	Wall Thick	Pressure	Joint Type	Material	Admin						
Edit	-2.3	485	4				PVC	Delete						
Edit	-2.3	421	6	0.28		WELDED	STEEL	Delete						

Add record										Completion table records			View Audit History	
Opt	From	To	Dia	Num of Openings	Size of Openings	Description			Admin					
Edit	475	485	4		0.020	SCREEN-CONTINUOUS-PVC			Delete					

Warnings and Violations

PORTAL:

The screenshot shows the NGWMN portal interface. A modal window titled "MBMG-133392" is open, displaying the following information:

Basic Well Information

Well Depth (ft)	600.00	Latitude	-112.6863
Elevation (ft, NGVD29)	5182.40	Longitude	45.1642

Casing Details

Depth from (ft)	Depth to (ft)	Diameter (in)	Material
-2.30	485.00	4.00	PVC
-2.30	421.00	6.00	STEEL
-2.30	485.00	4.00	PVC
-2.30	421.00	6.00	STEEL

Note: Positive depth values are depth below the surface, negative values are distance above the surface.

Screen Details

Depth from (ft)	Depth to (ft)	Diameter (in)	Material
475.00	485.00	4.00	SCREEN-CONTINUOUS-PVC
475.00	485.00	4.00	SCREEN-CONTINUOUS-PVC

Note: Positive depth values are depth below the surface, negative values are distance above the surface.

Well casing and/or screen data provided by MBMG

After consultation with NGWMN Portal staff, we determined that an MBMG script was the source of the error. This was quickly rectified.

- **Notice of any changes in databases or web services that are being planned that would impact future integration of the web services with the NGWMN data portal**

There are no planned changes to the MBMG web services.